

### A History of "Standards"

by Norman Simenson, AIT-5

When humans began to engage in commerce and found it was practical to specialize in the manufacture or harvesting of a few things and trade for everything else, civilization was born. Even before then, it was realized that there were fundamental problems involved in measuring things. Particularly if the measured thing was to be delivered at some future time. In direct barter, there is little opportunity for someone getting shortchanged because both

parties see what they are getting. In agreeing on some future delivery, both sides have to agree on how the things to be delivered are to be measured if the things are not simply exchanged. Otherwise, someone is bound to feel cheated.

Once civilization is born, there is taxation. And, to be fair, taxation must be based on some standard measure. Most of the simple instruments of measure are easily come by (if not as easily agreed to). A scale is a simple balance. Any stick can be used as a standard measuring rod, any container as a standard of volume, and any rock or lump of metal can be used as a standard

weight. The spread of civilizations and empires can be traced through the study of the spread of ancient measures. Cubits can be traced from Chaldea to Egypt, through Babylon, Asia Minor and, ultimately, to England. But, in Athens, the foot was three-fifths of a cubit. In early Egypt, a foot was two-thirds of a cubit. Most Chinese foot measures were longer than the modern English foot, while many of the foot measures adopted in Europe were shorter—though some foot measures in Italy were longer than an Egyptian cubit!

Most units of length derived from parts of the body. The digit, the width of the middle finger, was about three-fourths of an inch. The width of a thumb was about one inch. A palm, the width of four fingers, about three inches. The width of the full hand was about four inches. The span, the distance covered by the spread hand, about nine inches. The foot, about 12 inches. The cubit, from the elbow to the tip of the middle finger, about 18 inches. The yard, measured from the tip of the nose to the closed thumb and forefinger of an outstretched arm and hand, about 36 inches. Standards were evolved first by groups, then by communities. The standards agreed to

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### How "Open" Is Your System? (part 1)

by P. A. Dargan

Imagine being able to sit at any computer and execute a software application, unconcerned about where the application and data are located, whether the computer is the "right" platform, or whether there is sufficient memory capacity, disk space, and network transmission speed. This is the open systems vision, where the computer automatically and transparently takes care of these concerns.

### Moving to Standards

To achieve that vision, standards were necessary that went beyond "plug and play" standards for computer hardware: analogous standards were needed for software.

If we analyze software applications, we discover that many require the same services:

- *Data Management Services:* functions to structure, access, store, recover, and modify data.

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- **Data Interchange Services:** standard data formats to facilitate information exchange between applications.
- **Software Engineering Services:** programming languages and other tools for software development.
- **Graphics Services:** processing functions to generate and manipulate 2D and 3D images.
- **Human Computer Interface (HCI) Services:** user interface functions such as window management and menuing.
- **Operating System Services:** core services to interface between the computer and

applications, such as running programs.

- **Network Services:** data communications, file management, and related functions.

And if the system infrastructure — traditionally the communications backbone — was expanded to include these common services, then the result would be reusable building blocks for software applications.

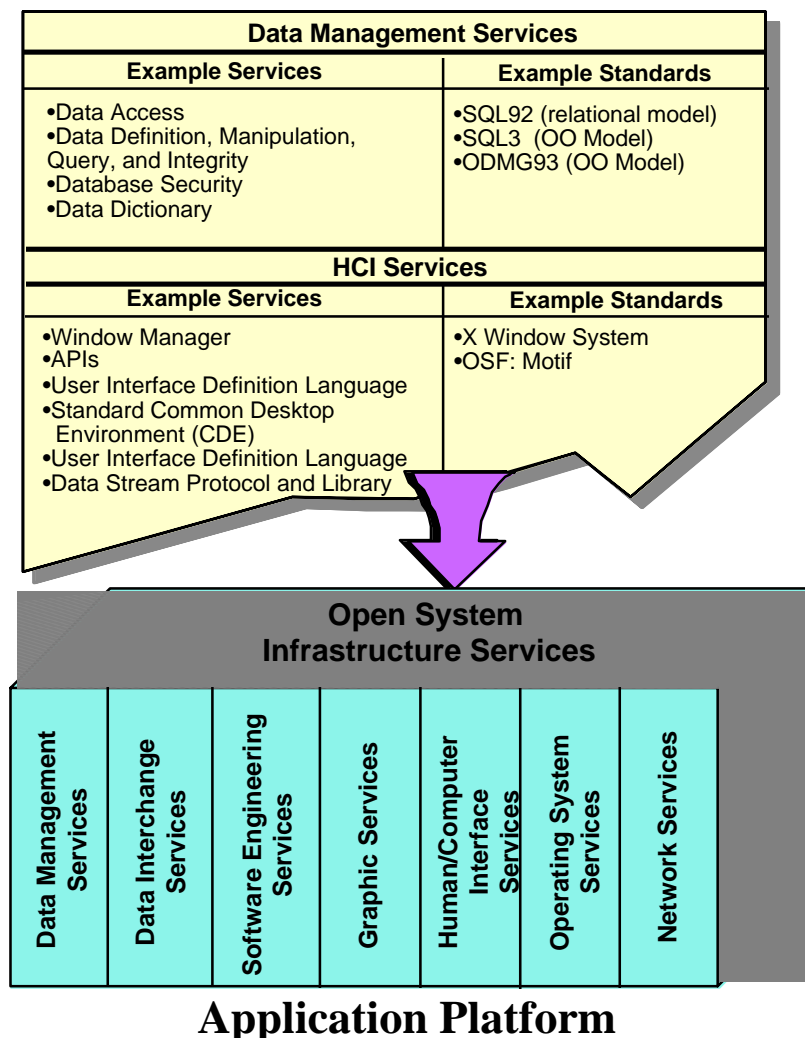
Standards bodies and consortia such as The Open Group (TOG) have defined public specifications for these services, along with some new ones, and made the specifications available for implementation. These public specifications are today's open system standards for multi-

vendor computers. Base a system infrastructure on them, and the result is an *open system infrastructure* (see Figure 1).

*So your system is "open" if the system infrastructure is based on open system standards — but just how "open" depends on the standards selected and commercial products used.*

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Figure 1. Open System Infrastructure Services

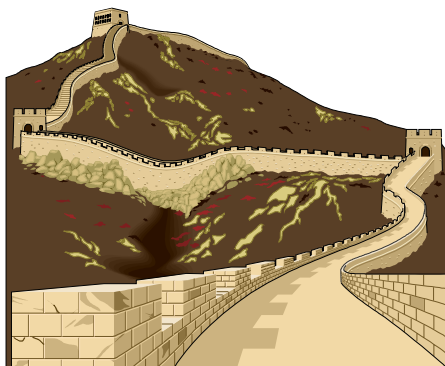


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by members of one community might differ significantly from that agreed upon by the next. A conqueror would try to impose the use of her standards. But frequently, old standards disappeared only from "official" use. Trades and crafts, long accustomed to a particular set of standards, resisted change. Through much of history, many crafts have kept their own peculiar standards and terms—printers still speak in terms of ens, ems, and picas. To this day, a pound of gold (Troy) weighs about 18% less than a pound of feathers (Avoirdupois). But an ounce of gold weighs 10% more than an ounce of feathers!

Almost from the beginning, the first act of any new ruler was to "reform" the standards used in his or her domain to eliminate cheating. Until fairly recent times, the new ruler always failed! Standards had a way of shrinking or growing as suited the advantage of the merchant (or the tax assessor). It was extraordinarily difficult to agree on a "standard" which did not change and which was uniform across the kingdom. These objects known as weights and measures are older than written history, but their simplicity is deceptive. No attempt by man to control the environment has been as ludicrously unsuccessful as the countless "reforms" of weights and measures.

Shih Huang-Ti was a founder of the Chinese Empire who was responsible for building the Great Wall against the Mongols. He had a plan for Chinese unity for all time: one law, one weight, and one measure, in place of the many laws, weights, and measures in use when he ascended the throne. The



Great Wall remains. His law outlasted him. But his standards of weights and measures did not even succeed in his lifetime.

Charlemagne tried it, and William the Conqueror, and Henry VIII and his daughter Elizabeth, and Talleyrand. The rulers of ancient Egypt swore by Isis to preserve the sacred cubit. Standards of weight were sealed by the priests of ancient Sumer at the beginnings of recorded history. Standards of length were built into the pyramids and into the churches of early France and England.

Proverbs II.I declares, "A false balance is abomination to the Lord, but a just weight is His delight." In the eight thousand years since Sumer, there has been much for the Lord to abominate, for balances lied and weights were false. Whatever means the "authorities" found to guard a standard from corruption, dozens of schemers found ingenious ways to circumvent. It all depended upon what was being measured, and where, and when, and by whom, and for whom. A "foot" might equal 10 modern inches, or 13, or even 27.

This is history, but even as recently as our own century, in Brooklyn, New York, the city surveyors recognized as legal four different "feet": the United States foot, the Bushwick foot, the Williamsburg foot, and the foot of the 26th Ward. All legal, all different. Some strips of Brooklyn were untaxable because, after surveys made with different units, these strips didn't legally exist!

The history of scientific national standards begins with two dramatic events: a revolution and a fire. The French Revolution of the 1790's resulted in the metric system. A fire destroyed the Houses of Parliament in 1834, ruining the existing British standards. In their reconstruction, the imperial system of weights and measures was born. Today, the international standard is the metric system. Only the United States still measures in inches, pounds and quarts. But even the international inch is defined as exactly 2.54 centimeters.

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## HELPFUL HINTS

### New EIA Standard Out for Review

A new EIA Standard 632, Processes for Engineering a System, is currently under review by a committee including members from government and industry. Development of this standard was accomplished as a joint project of the Electronics Industries Association (EIA), the Institute of Electrical and Electronics Engineers (IEEE), and the International Council on Systems Engineering (INCOSE). The purpose of this standard is to aid the integrated development and realization of End Products and Associated Processes of a System. Use of this standard in the engineering of a system is intended to help developers a) identify and balance competing requirements from different stakeholders, b) establish and evolve validated technical requirements, and c) ensure that technical requirements are met within cost, schedule, and risk constraints. This standard includes activities required to: (1) plan and control the engineering tasks of a project, (2) define the System Requirements, (3) develop and define acceptable design solutions, and (4) verify that the design solutions satisfy validated System Requirements. 🏠

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In the past, “measurement” meant length, mass, volume, and time. To maintain standards, units of weight, length, and volume were locked into the king’s vaults, while the sun passing overhead provided the time standard. But many modern phenomenon cannot be so measured. Entirely new units of measurement are needed, as well as more accurate versions of the old units. The rotation of the earth (and, hence, the passage of the sun overhead) turns out to be very inaccurate. It varies by many microseconds a day. And it changes over time. (From time to time, we have to add a “leap” second to the day.) The “standard” meter in Paris, even hermetically sealed in an inert gas, is constantly shedding atoms. Even held to a “standard” temperature and pressure it is still is distorted by local gravity and similar influences. Accuracy refers to the “trueness” of a measure; precision refers to the number of decimal places we can use before the error of measurement wins out. The “standard” meter cannot be used to help us measure nanometers because of the inaccuracies inherent in trying to divide the standard by 1000000000!

So, today, we substitute the “active” science of metrology for the “passive” legal act of measurement. We have added many standard units to the basic set: volts, amperes, ohms, hertz—to name just a few. The United States National Institute of Standards and Technology (NIST) is the source of perhaps a thousand standards, and more

are constantly being added. If you have a piano in your house, it was tuned to a NIST “A”—just as your clock was set to NIST time of day, broadcast by WWV in Boulder, Colorado.


In the area of software engineering, ACM has had a SIG which has published the periodical “Standard View” for about the past four years. All you ever wanted to know about software standards. To quote from the introduction to a recent article by Brian Meek, *Too Soon, Too Late, Too Narrow, Too Wide, Too Shallow, Too Deep*, volume 4, Number 2:

“What makes standards succeed or fail is the subject of much speculation, often during late-night chat. Speculation it always remains: firm conclusions are never reached, or do not bear the scrutiny of cold and sober dawn. Anecdotal evidence is not in short supply, and case studies can be done, but little can be translated into general principle. Standards, it seems, are sensitive plants; one will “take” and thrive, while another, to all appearances equally fit, will struggle to survive at all.”

## Just a Word on Interfaces

The NAS is a highly complex system which requires interfaces between people, regulations, procedures, and sophisticated hardware/software which all function together as a network. These interfaces are only a few examples which make the NAS work safely and effectively. It is not only necessary for these complex interfaces to be physically connected, but they must be able to exchange information intelligently. This requires a discipline which allows for a thorough review of the mechanical design and correct flow of data at all levels of decomposition to best ensure an approach which meets the needs of the NAS. This information can only be obtained through the proper application of standards or guidance documentation at the project level.

Interface control is one example of a process that is most often implemented through a body, comprised of people from impacted organizations,

called an Interface Control Working Group (ICWG). Electronics Industries Standard EIA/IS 649 describes interface control as “The process of identifying, documenting, and controlling all performance, functional, and physical attributes relevant to the interfacing of two or more products provided by one or more organizations.” The application of guidance in a standard such as this, will ensure that a more effective approach will be taken in redefining the interface management process. It makes sense based on today’s new concepts of doing business. 

## Editor’s Flashpoints

The application of standards is a current topic of discussion in many organizations within the FAA. Some feel that the selection of standards should be left totally at the discretion of each program office. Others feel that a set of standards should be strictly enforced. There is even one train of thought which questions the use of standards as a valuable part of the acquisition process. The dilemma presented here is determining the most efficient way to ensure that requirements referenced in the documentation satisfy user needs in the procurement process for new FAA NAS systems. There are a few things to consider in trying to answer this question. One faction suggests that standards of any kind are nothing but a hindrance to the acquisition process and should be eliminated completely. COTS components are out there so why not use what is commercially available and use them to develop a specified system for the NAS? Why waste valuable time and resources in developing new custom components? Consider, however, a requirement to interface with a system that was developed five years ago. How do you communicate with the older generation system? Interoperability will continue to be a major concern as long as the need exists for systems of different generations to communicate with each other. Thus the need to apply some kind of roadmap, template, or standard. 